CPAP Masks are Sources of Microbial Contamination
Alex Horowitz, Sandra Horowitz MD FRCP(C), Chinhak Chun MD
SleepHealth Centers, Division of Sleep Medicine, Brigham and Women’s Hospital, Harvard Medical School, Boston

RATIONALE AND AIMS
- CPAP compliance is a priority in managing apnea patients. An area that has had little investigation is a patient’s ability to care for their CPAP at home and the effect this may have on utilization. Patients may have more nasal congestion and sneezing limiting CPAP use.
- Respiratory therapists advise patients to wash the interface weekly.
- Just as simple hand washing is recommended as the best way to prevent spread of bacteria and viruses such as N1T1, cleaning CPAP equipment should decrease spread of upper respiratory and oral pathogens. Patients carry their masks largely unprotected for months, taking them outside the home into hospitals, on planes and other environments conducive to growth of pathogens.
- Studies of nasal cytology have noted patients with higher nasal neutrophil count were more likely to abandon CPAP.

METHODS
- 24 of 30 consecutive patients had CPAP interfaces >1 month old submitted for culture.
- Patients were 16 men and 8 women age range 24-64 years old.
- 42% of patients had AHI >40 and all had AHI >20
- Objective and subjective compliance data were recorded and CGI scores were measured as well as frequency of mask/humidifier cleaning and age of interface.
- Swabs were taken from the inner surface of the mask and the base of hose and humidifier.
- Bacterial cultures were examined and gram stained at 24 and 48 hours, fungal cultures at 72 hours.
- We correlated frequency of cleaning and severity of apnea as well as interface styles and mask age with bacterial colony counts.

RESULTS
- Total number of colonies measured at 48 hours - Counts are reported from the swab on the inside surface of the interface:
  - 1-11 colonies per plate 31%
  - 10-50 21%
  - >2000 48%
- There was no significant correlation of colony counts with reported frequency of cleanings.
- There was a correlation with mask age; older masks grew copious amounts of bacteria and fungi.
- The type of interface was not a factor, but numbers were small (9 full face, 11 nasal, and 4 nasal pillows); the inside of the mask was the most reliable source or organisms.
- Overall there was a high level of bacterial growth from CPAP masks. It consisted of the normal types of skin flora including gram positive cocci with some gram positive and negative rods, yeast, and gram negative cocci (all benign except for 2 patients that had Staph aureus isolated).
- No patients reported more colds since CPAP, but 8 complained of nasal congestion.
- Patient Reported Cleaning Frequency:
  - 29% nightly, 33% twice/week, 25% 1-4 times/month, and 12.5% never
- Age of Interface:
  - 1-3 months 8 Patients, 4-6 months 5 PT, 6-12 months 7 PT, and >1 year 4 PT
- Compliance data had nightly usage at 0.68 to 11.7 hours. There was good agreement among high objective usage patients > 6 hours, but poor agreement in low usage patients (4 hours), between objective and subjective compliance.

DISCUSSION
- Microbes that colonize the skin are often harmless, but when the balance of the skin environment changes, several genera of aerobes and anaerobes can cause infections.
- We correlated frequency of cleaning and severity of apnea as well as interface styles and mask age with bacterial colony counts.
- There was a high incidence of bacterial growth as well as fungi and occasional yeast – all plates had positive growth.

CONCLUSION
- We need to pay more attention to the care and cleanliness of CPAP interfaces, in contact with the skin, mouth, nasal cavity, and then used repeatedly for months, even years. Patients may not be able to understand instructions without reinforcement by respiratory therapists.
- Our “good patient” group had high compliance and high CGI scores, but still scored low in cleaning frequency and efficacy.
- There was a high incidence of bacterial growth as well as fungi and occasional yeast – all plates had positive growth.
- The older interfaces had significantly more fungi and overall higher colony counts, and more diversified bacterial populations.
- We found a high incidence of bacterial and fungal mask contamination in our group of CPAP users. The patient’s reported frequency of cleaning and severity of apnea did not seem to be an important factor as the age of the equipment.
- There is a phenomenon noticed in other medical equipment where a slow build up of a “biofilm” of microscopic algae, adheres to latex and silicone, and is used in catheters and other types of medical equipment, rendering them difficult to fully disinfect. This may be what is happening to our older CPAP interfaces.

Acknowledgements: Neil Gillis Lab Supervisor, Metrowest Medical Center